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Method and device for separating flat consignments

The invention relates to a method and a device for separating flat consignments by means of a plurality of successive take-off elements having acceleration stages, whereby the take-off elements act on one side on the sides of the consignment in the take-off plane.

The performance of a sorting system is determined substantially by the throughput and the quality (double take-off rate and damage rate) of its separation facility in the feed region. In this situation, the throughput is limited by the recognition of a separated consignment (detection of the trailing edge) and the acceleration of the next consignment. The greater the jump in speed between the separated consignment and the following consignments, the longer it takes to accelerate the consignment. The gap between the consignments thus becomes greater.

The separation has previously been implemented using transport facilities, mechanical hold-back elements and detection of consignments in the separation region. These sensors can only detect the leading and trailing edges of consignments and influence the control of the separation by means of the measurement signals if the consignments have already been separated (DE 198 01 309 C1, DE 34 24 397 A1).

A method and a device for separating flat consignments by means of a single acceleration stage are known from US 5 429 347 A. The acceleration stage comprises take-off elements which act on one side of the consignments. The speed of a consignment lying on the take-off element is measured by means of a sensor which is implemented as a roller driving a tachogenerator and is positioned on the side of the take-off element. The trailing edge of this consignment is detected by a control unit from the measured speed characteristic and the drives of the take-off elements are controlled appropriately.

In addition to a single-stage separation process, a multi-stage separation is also known in which the nominal take-off speed of the take-off elements in a downstream acceleration stage is higher than in an upstream acceleration stage (DE 102 12 024 A1).

The object of the invention is to create a method and a device for separating flat consignments, which allow overlapping consignments to be withheld better.

This object is achieved according to the invention by the features described in Claims 1 and 7.

With regard to a plurality of successive acceleration stages, the nominal take-off speed of the take-off elements in each acceleration stage is higher than the nominal take-off speed of the take-off elements upstream in the direction of transport in each case in the acceleration stage.

In the feed region for the respective acceleration stage, the speed of the consignment lying on the take-off element(s) is measured by means of a sensor T1 which is positioned on the side of the take-off element.

As soon as the speed of the consignment lying on the take-off elements, which is measured in the feed region of each acceleration stage by means of the sensor T1 located on the side of the take-off elements, deviates by only a defined low value from the nominal speed of the take-off elements in said acceleration stage, in other words as soon as the consignment has been received by said acceleration stage practically without slippage, the speed of the take-off elements of the upstream acceleration stage in the direction of transport is reduced. This permits overlapping consignments to be withheld.

Advantageous embodiments of the invention are set down in the subclaims.

The sensors T1 are advantageously located between the acceleration stages.

In order to also determine the speed of overlapping consignments additionally dragged along during the take-off operation, it is advantageous to additionally measure the speed of the consignments which can be sensed from the side facing away from the take-off elements in the region of the acceleration stages downstream in the direction of transport by means of the sensor T2 located on the side facing away from the take-off elements.

In order to ascertain when the take-off elements need to be renewed due to phenomena of wear, it is advantageous to compare the speeds of the take-off elements and of the

consignments driven by them with one another in order to determine slippage and, when deviations lying above a defined limit value are exceeded, to generate a service signal.

It is advantageous to reduce the speed in the upstream acceleration stages to 0.

It is particularly advantageous if the speed of the consignments is measured additionally in the region of each acceleration stage downstream in the direction of transport by means of a sensor T2 which is located on the side facing away from the take-off elements, and as soon as the thus measured speed of the consignments deviates by only a defined low value from the nominal speed of this downstream acceleration stage after the reduction of the speed of the take-off elements in the respective upstream acceleration stage the speed of the take-off elements of the respective upstream acceleration stage is again increased to its nominal speed. As soon as the leading edge of a consignment detected by means of the sensor T2 of the downstream acceleration stage is registered as a measured jump in speed from v to v, the speed of the take-off elements for the respective upstream acceleration stage is changed to the value 0. As soon as the consignment speed measured by the sensor T1 between the two adjacent acceleration stages has dropped from the speed of approximately v to the value 0, the take-off elements for the respective upstream acceleration stage are accelerated to the nominal take-off speed. The distance between the beginning of the respective acceleration stage and the associated sensor T2 and thus the holding point for the leading edge of the following consignment is chosen depending on the difference between the nominal speeds of the respective acceleration stage and the upstream acceleration stage such that the two adjacent consignments exhibit a defined distance from one another at the end of the respective acceleration stage. As a result of this procedure, small gaps are achieved between the separated consignments in spite of major differences in the size of the consignments.

An embodiment of the invention will be described in the following with reference to the figure.

In the drawing:

Figure 1 shows a schematic top view of two acceleration stages of a separating device having two speed sensors

When taking off consignments 3,4 according to Figure 1 by means of a first acceleration

stage 1 from a stack of consignments which is not shown, not only the frontmost consignment 3 of the consignment stack lying on the take-off elements, for example a continuous take-off belt with vacuum chamber support, has been taken off but two further consignments 4 have also been dragged along. This first stage can also be a pre-separation stage which the consignments 3,4 exit in overlapped fashion. At least the frontmost consignment 3 is transported at a nominal speed vA1 to the following acceleration stage 2. As soon as it is acquired there by the take-off elements, it is transported onward at a higher speed vA2. A sensor T1 5 measuring the speed of the consignments lying on the take-off elements is located between the two acceleration stages 1,2. The speed measurement is implemented here by means of a roller running on the surface of the consignment and driving a tachogenerator. The output signal from the tachogenerator corresponding to the rotational speed is transferred as a measurement signal to a device for controlling the drives of the acceleration stages. If the gap between the acceleration stages 1,2 is very small or not present at all, this sensor T1 5 in the feed region of the respective downstream acceleration stage 2 can be located between the drive belts. When the respective consignment 3 exits the upstream acceleration stage 1, then its speed is monitored by the sensor T1 5. If the difference between the speed of the take-off element of the downstream acceleration stage 2 and the speed of the consignment 3 is less than a defined low limit value, a pick-up of the consignment 3 practically without slippage by the take-off elements of the downstream acceleration stage 2 can be assumed. From this point in time, the speed of the take-off element of the upstream acceleration stage 1 is reduced (to the value 0 at most) such that the take-off element acts as a hold-back element and prevents or at least impedes the conveyance of the following consignments. In the region of the acceleration stage 2 downstream in the direction of transport a further sensor T2 6 is located on the side facing away from the take-off elements, which measures the speed of the consignments 3,4 that can be sensed from this side. While the consignment 3 exits the transition between the two acceleration stages 1,2 approximately at the speed v_{A2}, the speed v_{T2} measured by the sensor T2 6 is monitored. If the speed difference between v_{A2} and v_{T2} is greater than a defined low limit value, then it can be assumed that the leading edge of the following consignment 4 is not yet situated at the sensor T2 6 and the take-off element of the upstream acceleration stage 1 is accelerated from the reduced speed to its nominal speed. As a result, the following consignments are transported forwarded at the nominal speed to the sensor T2 6. When the sensor T2 6 detects the leading edge of the following consignment 4 by registering a jump in speed to the nominal speed v_{A1} of the take-off element of the upstream acceleration stage 1, the take-off element of the upstream acceleration stage 1 is

stopped and again acts as a hold-back element.

If the leading edge of the following consignment 4 lies a long way back, one of the following conditions is satisfied:

- A gap forms in the transition between the take-off elements.
- The first consignment 3 exits the sensor T1 5 with its trailing edge.